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Description

The present invention relates to an evaporator for use in a refrigerator according to the preamble of claim 1 and to a method of manufacturing such an evaporator.

An evaporator of this type is disclosed by US-A 4 535 600. In this evaporator, the freezer and storage evaporator portions and the connecting portion are formed by a sheet of roll-bonded material having a continuous refrigerant channel in the form of a tube bulging on both surfaces thereof.

It is further known to prepare the roll-bonded material from a pair of upper and lower aluminum sheets one of which bears a pattern of adhesion preventing agent printed on its inner surface, by bonding the two sheets to each other under pressure and introducing a pressure fluid into the non-bonded portion to bulge this portion in the form of a tube.

In the production process of the roll-bonded material, the fluid is forced in between the two aluminum sheets at the nonbonded portion with one of the aluminum sheets held with a die over the outer surface thereof, so that the bulged tube portion is protuberant on only one surface of the material which is not held by the die.

When such a sheet of roll-bonded material having the bulged tube portion on one surface thereof is used for providing an evaporator portion for the freezer compartment of the refrigerator, an evaporator portion for the storage compartment under the freezer compartment, and a connecting portion interconnecting the two evaporator portions, it is likely that the evaporator portion especially for the bottom wall portion of the freezer compartment will be positioned with its bulged tube refrigerant channel portion facing outwardly (downwardly) of the freezer compartment. Since the refrigerant channel of the evaporator portion for the rear wall of the storage compartment is positioned on the same side as the refrigerant channel of the freezer evaporator portion, the refrigerant channel then faces the interior (front side) of the storage compartment. In the case where the evaporator portion is exposed inside the storage compartment, the presence of the refrigerant channel in the form of bulged tube impairs the appearance. If the evaporator portion is disposed on the rear side of the storage compartment rear wall and held out of sight, no problem will arise as to the appearance, whereas the bulged channel portion is then in contact with the rear surface of the storage compartment rear wall. This reduces the contact area of the evaporator to entail the problem of lower efficiency.

It is therefore an object of the present invention to provide an evaporator of the above type which is free of the above problems for use in refrigerators,

and to provide a method of manufacturing such an evaporator.

This object is achieved by an evaporator as defined in claim 1 and by a method as defined in claim 4.

Advantageous embodiments are defined in the subclaims.

According to the present invention, the freezer evaporator portion, the storage evaporator portion and the connecting portion of the evaporator is formed by a sheet of roll-bonded material having a tube portion bulged on one surface thereof. Nevertheless, the refrigerant channel portions of the freezer and storage evaporator portions can both be arranged as faced outward, with the flat surface of the evaporator positioned inside the storage compartment. In the case where the evaporator is visible directly from inside the storage compartment, the evaporator appears flat and neat because of the absence of the bulged refrigerant channel portion. Alternatively when the evaporator is disposed on the rear side of the storage compartment rear wall and made invisible from inside the compartment, the flat surface of the evaporator portion is in contact with the rear surface of the storage compartment rear wall. This gives a greatly increased contact area to the evaporator portion to achieve a remarkably improved efficiency.

The present invention will be described in greater detail with reference to the accompanying drawings.

FIG. 1 is a sectional view schematically showing a refrigerator having an evaporator embodying the invention;

FIG. 2 is a perspective view of the evaporator;

FIG. 3 is a plan view in development of the evaporator;

FIG. 4 is a fragmentary enlarged plan view of the evaporator of FIG. 3;

FIG. 5 is a view in section taken along the line V-V in FIG. 4; and

FIG. 6 is a plan view in development showing another evaporator embodying the invention.

Throughout the drawings, like parts are designated by like reference numerals.

With reference to FIGS. 1 and 2, a refrigerator has a freezer compartment 1 and a storage compartment 2 under the compartment 1.

The refrigerator has an evaporator embodying the invention and comprising an evaporator portion 11 for the freezer compartment 1, an evaporator portion 12 for the storage compartment 2, and a connecting portion 13 interconnecting the two portions. The evaporator is formed by a sheet of roll-bonded material 10 having a continuous refrigerant channel 14 in the form of a tube bulged on one surface of the material as seen in FIG. 3.

The evaporator portion 11 for the freezer compartment 1 is channel-shaped when seen from one side and provided on the bottom side, rear side and upper side of the compartment 1. The evaporator portion 12 for the storage compartment 2 is in the form of a flat plate and disposed on the rear side of the rear wall 2a of the storage compartment 2. The connecting portion 13 interconnecting the two evaporator portions 11, 12 is in the form of a strip.

With the present embodiment, the sheet of roll-bonded material 10 having the bulged tubular refrigerant channel 14 protuberant on one surface thereof is formed, in the portion thereof having no refrigerant channel and closer to its one end than the central portion thereof, with two cutouts 3, 3 opposed to each other and L-shaped and inverted L-shaped, respectively, when seen from above. The cutouts 3, 3 have respective long slit portions extending approximately in parallel to each other and respective short slit portions extending outward away from each other. When thus cut out, the freezer evaporator portion 11, the storage evaporator portion 12 and the striplike connecting portion 13 interconnecting the portions 11, 12 are formed at the same time.

The refrigerant channel portion 14a of the freezer evaporator portion 11 and the refrigerant channel portion 14b of the storage evaporator portion 12 are held in communication with each other by forward and return refrigerant channel portions 14c, 14d of the connecting portion 13. A refrigerant supply tube 15 and a refrigerant discharge tube 16 are connected to the respective ends of the channel portion 14a of the freezer evaporator portion 11.

The roll-bonded sheet 10 is bent to form the freezer evaporator portion 11 which is channel-shaped when seen from one side, with its channel portion 14a facing outward. The striplike connecting portion 13 is then folded over rearwardly downward, and at an intermediate part 13a of its height, the connecting portion 13 is twisted through 180 degrees within a horizontal plane, whereby the refrigerant channel portion 14b of the storage evaporator portion 12 is turned over and caused to face outwardly of the storage compartment 2 when the evaporator portion 12 is installed in place.

In this way, the bulged tubular channel portions 14a, 14b of the freezer and storage evaporator portions 11, 12 can be both arranged as faced outward by twisting the striplike connecting portion 13. Consequently, the flat surface of the evaporator portion 12 can be held in contact with the rear surface of the rear wall 2a of the storage compartment 2. This increases the area of contact between the rear wall 2a and the evaporator portion 12 to achieve a greatly increased efficiency.

The intermediate part 13a of the connecting portion 13 to be twisted has opposite side edges which are preferably tapered as seen in FIG. 4, because when the intermediate part 13a is thus tapered and then twisted through 180 degrees within a horizontal plane, the forward and return channel portions 14c, 14d will not be easily folded in a collapsed fashion but are more likely to remain unblocked.

With reference to FIG. 4, suppose the intermediate part 13a to be twisted has a length L, and the larger width of the intermediate part 13a is W. When the intermediate part 13a is 150 to 300 mm in length L and 30 to 60 mm in width W, the effective taper of the intermediate part 13a is 1.5/100 to 5/100. If the taper of the intermediate part 13a is in this range, the forward and return channel portions 14c and 14d remain unblocked when the intermediate portion 13 is twisted.

With reference to FIG. 5, the roll-bonded material 10 for forming the evaporator is prepared from a pair of upper and lower aluminum sheets 17, 18 one of which bears a required pattern of adhesion preventing agent printed on its inner surface, by bonding the two sheets to each other under pressure and introducing a pressure fluid into the nonbonded portion to bulge this portion in the form of a tube and form the continuous refrigerant channel 14.

FIG. 6 shows another embodiment of the present invention which differs from the above embodiment in the pattern of refrigerant channel 14 of the roll-bonded material 10 for forming the evaporator. More specifically, the pattern of the bulged tubular refrigerant channel 14 of the second embodiment is such that the refrigerant flows from the channel portion 14a of the freezer evaporator portion 11 to the channel portion 14b of the storage evaporator portion 12 through a single forward refrigerant channel portion 14c of the connecting portion 13 therebetween. A refrigerant supply tube 15 is connected to one of the channel 14, i.e., to the outer end of the channel portion 14a of the freezer evaporator portion 11, and a refrigerant discharge tube 16 is connected to the other end of the channel 14, i.e., to the outer end of the channel portion 14b of the storage evaporator portion 12.

According to the embodiments described, the freezer evaporator portion 11 of the evaporator is channel-shaped when seen sidewise and disposed on the bottom side, rear side and upper side of the freezer compartment 1, but the freezer evaporator portion 11 may be provided at least on the bottom side of the freezer compartment 1.

Although not shown, the storage evaporator portion 12 of the evaporator of the present invention is provided alternatively inside the storage compartment and made directly visible. Even in

this case, the flat side of the evaporator portion 12 is positioned inside the storage compartment according to the present invention. The evaporator portion 12 therefore will not appear unsightly.

Claims

1. An evaporator for use in a refrigerator having a freezer compartment (1) and a storage compartment (2) under the freezer compartment, the evaporator comprising a freezer evaporator portion (11) positionable at least on the bottom side of the freezer compartment, a storage evaporator portion (12) positionable on the rear side of the storage compartment and a striplike connecting portion (13) which interconnects the two evaporator portions and which is folded over rearwardly downward, the freezer and storage evaporator portions and the connecting portion being formed by a sheet (10) of roll-bonded material having a continuous refrigerant channel (14) in the form of a tube, **characterized** in that said refrigerant channel (14) is in the form of a tube bulging on only one surface of said sheet (10), and that the freezer evaporator portion (11) is positionable with its bulging refrigerant channel portion (14a) facing outwardly of the freezer compartment (1), the connecting portion (13) being twisted by 180 degrees at an intermediate part (13a) of its height to position the storage evaporator portion (12) with its bulging refrigerant channel portion (14b) facing outwardly of the storage compartment (2).
2. An evaporator as claimed in claim 1, **characterized** in that the intermediate part (13a) of the connecting portion (13) to be twisted has tapered opposite side edges when seen from above.
3. An evaporator as claimed in claim 2, **characterized** in that the intermediate part (13a) of the connecting portion (13) is 150 to 300 mm in length and 30 to 60 mm in the larger width and has an effective taper of 1.5/100 to 5/100.
4. A method of manufacturing an evaporator as claimed in claim 1, **characterized** in that the sheet (10) of roll-bonded material is formed, in the portion thereof having no refrigerant channel and closer to its one end than the central portion thereof, with cutouts (3) opposed to each other and L-shaped and inverted L-shaped respectively when seen from above to thereby provide the freezer evaporator portion (11), the storage evaporator portion (12) and the striplike connecting portion (13) intercon-

necting the two evaporator portions, the freezer evaporator portion of the roll-bonded sheet being bent to a channel shape when seen side-wise so as to be positioned on the bottom side, rear side and upper side of the freezer compartment (1), the connecting portion being folded over rearwardly downward and twisted through 180 degrees within a horizontal plane at the intermediate part (13a) of its height.

Patentansprüche

1. Verdampfer zur Verwendung mit einem Kühlschrank, der ein Gefrierfach (1) und ein Aufnahmefach (2) unterhalb des Gefrierfachs aufweist, welcher Verdampfer einen Gefrier-Verdampferbereich (11), der wenigstens am Boden des Gefrierfachs angeordnet werden kann, einen Aufnahmefach-Verdampferbereich (12), der an der Rückseite des Aufnahmefachs angeordnet werden kann, und einen streifenförmigen Verbindungsbereich (13) umfaßt, der die beiden Verdampferbereiche verbindet und der nach rückwärts und unten umgefaltet ist, wobei die Verdampferbereiche des Gefrierfachs und des Aufnahmefachs und der Verbindungsbereich durch ein Blech (10) aus Roll-Bond-Material mit einem kontinuierlichen Kältemittelkanal (14) in der Form eines Rohres gebildet sind, dadurch **gekennzeichnet**, daß der Kältemittelkanal (14) die Form eines Rohres aufweist, das nur auf einer Oberfläche des Bleches (10) ausgebaucht ist, und daß der Gefrierfach-Verdampferbereich (11) mit seinem ausgebauchten Kältemittelkanalbereich (14a) zur Außenseite des Gefrierfachs (11) gerichtet ist, während der Verbindungsbereich (13) um 180° in einem Mittelbereich (13a) seiner Höhe gedreht ist, so daß der Aufnahmefach-Verdampferbereich (12) mit seinem ausgebauchten Kältemittelkanalbereich (14b) zur Außenseite des Aufnahmefachs (2) gerichtet ist.
2. Verdampfer nach Anspruch 1, dadurch **gekennzeichnet**, daß der Mittelbereich (13a) des Verbindungsbereichs (13), der zu verdrehen ist, schräg zusammenlaufende seitliche Ränder in der Ansicht von oben aufweist.
3. Verdampfer nach Anspruch 2, dadurch **gekennzeichnet**, daß der Mittelteil (13a) des Verbindungsbereichs (13) eine Länge von 150 bis 300 mm und eine größere Breite von 30 bis 60 mm aufweist und mit einer effektiven Abschrägung von 1,5/100 bis 5/100 versehen ist.

4. Verfahren zur Herstellung eines Verdampfers gemäß Anspruch 1, dadurch gekennzeichnet, daß das Blech (10) des Roll-Bond-Materials in seinem Bereich, der keinen Kältemittelkanal enthält und näher seinem einen Ende als der Mittelbereich liegt, mit einander gegenüberliegenden Ausschnitten (3) versehen ist, die L-förmig und umgekehrt-L-förmig in Draufsicht ausgebildet sind und auf diese Weise den Gefrierfach-Verdampferbereich (11) den Aufnahmefach-Verdampferbereich (12) und den streifenförmigen Verbindungsbereich (13), der die beiden Verbindungsbereiche verbindet, bilden, wobei der Gefrierfach-Verdampferbereich des Roll-Bond-Bleches zu einer Kanalförmigkeit in Seitenansicht gebogen wird, so daß er auf der Bodenseite, der Rückseite und der oberen Seite des Gefrierfaches (1) liegt, wobei der Verbindungsbereich nach rückwärts und abwärts umgefaltet und über 180° in einer waagerechten Ebene im Mittelteil (13a) seiner Höhe gedreht wird.

Revendications

1. Evaporateur destiné à être utilisé dans un réfrigérateur qui comporte un compartiment de congélation (1) et un compartiment de conservation (2) placé sous le compartiment de congélation, l'évaporateur comprenant une section d'évaporateur pour la congélation (11) apte à être disposée au moins sur la face inférieure du compartiment de congélation, une section d'évaporateur pour la conservation (12) apte à être disposée sur la face arrière du compartiment de conservation et une section de raccordement en forme de bande (13) qui relie l'une à l'autre les deux sections d'évaporateur et qui est rabattue sur elle-même vers l'arrière et vers le bas, les sections d'évaporateur pour la congélation et la conservation et la section de raccordement étant formées par une feuille (10) de matériau soudé par laminage comportant un canal à réfrigérant continu (14) sous la forme d'un tube, caractérisé en ce que ledit canal à réfrigérant (14) présente la forme d'un tube saillant sur une seule surface de ladite feuille (10), et en ce que la section d'évaporateur pour la congélation (11) peut être disposée avec son tronçon de canal à réfrigérant saillant (14a) tourné vers l'extérieur du compartiment de congélation (1), la section de raccordement (13) étant torsadée sur 180 degrés, au niveau d'une partie intermédiaire (13a) dans le sens de sa hauteur, pour positionner la section d'évaporateur pour la conservation (12) de telle façon que son tronçon de canal à réfrigérant saillant soit tourné vers l'ex-

térieur du compartiment de conservation (2).

2. Evaporateur tel que revendiqué dans la revendication 1, caractérisé en ce que la partie intermédiaire (13a) de la section de raccordement (13) à torsader, présente, vue de dessus, des bords latéraux opposés convergents.
3. Evaporateur tel que revendiqué dans la revendication 2, caractérisé en ce que la partie intermédiaire (13a) de la section de raccordement (13) a une longueur de 150 à 300 mm et une largeur maximum de 30 à 60 mm et présente un rétrécissement effectif de 1,5/100 à 5/100.
4. Procédé pour fabriquer un évaporateur tel que revendiqué dans la revendication 1, caractérisé en ce que la feuille (10) de matériau soudé par laminage est dotée, dans sa partie dépourvue de canal à réfrigérant et plus près de son extrémité correspondante que de sa partie centrale, de découpes (3) opposées l'une à l'autre et ayant respectivement, vues de dessus, la forme d'un L et la forme d'un L renversé, pour que soient ainsi définies la section d'évaporateur pour la congélation (11), la section d'évaporateur pour la conservation (12) et la section de raccordement en forme de bande (13) reliant l'une à l'autre les deux sections d'évaporateur, la section d'évaporateur pour la congélation de la feuille soudée par laminage étant pliée sous la forme d'un U, en vue de côté, afin d'être placée sur la face inférieure, la face arrière et la face supérieure du compartiment de congélation (1), la section de raccordement étant rabattue sur elle-même vers l'arrière et vers le bas et torsadée sur 180 degrés dans un plan horizontal, au niveau de la partie intermédiaire (13a) dans le sens de sa hauteur.

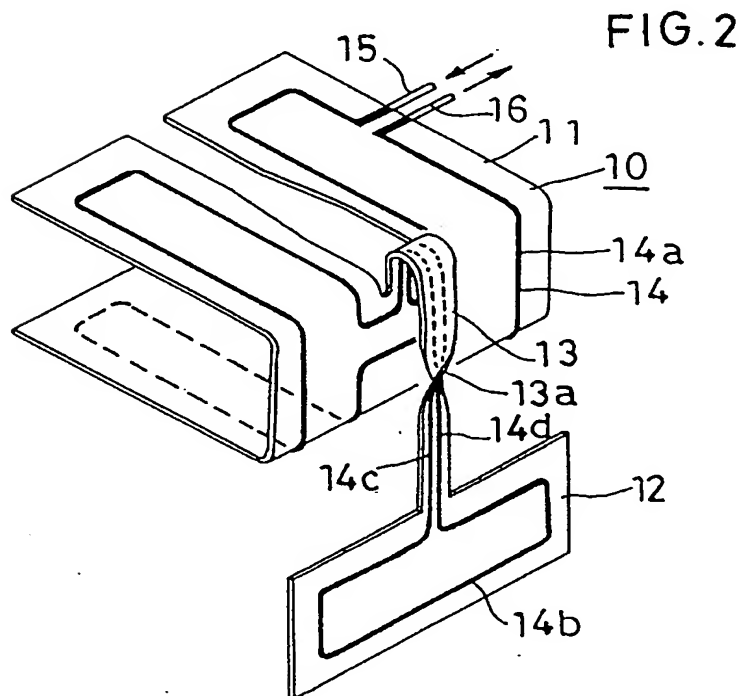
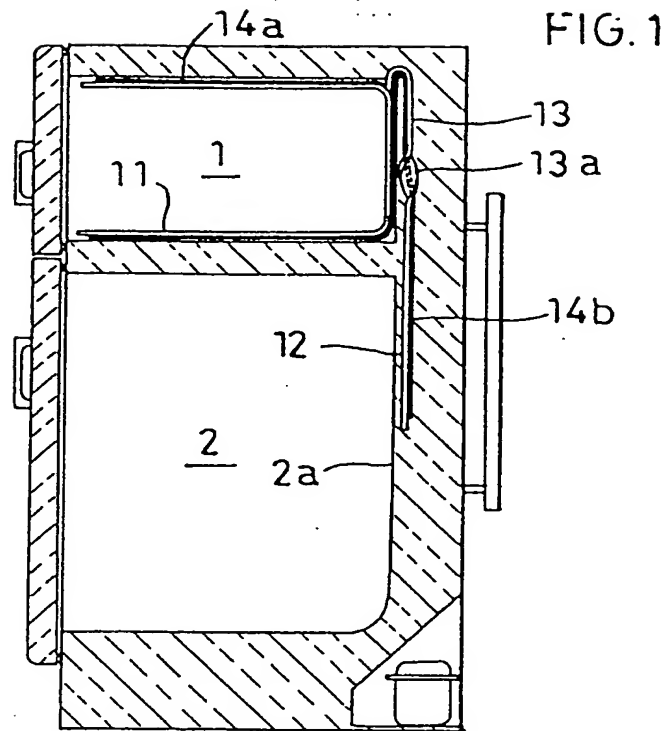


FIG. 3

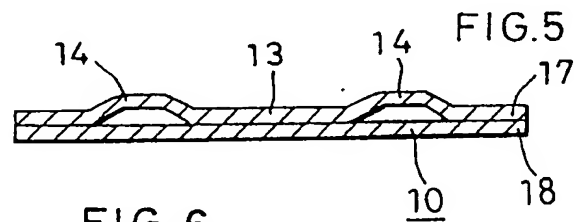
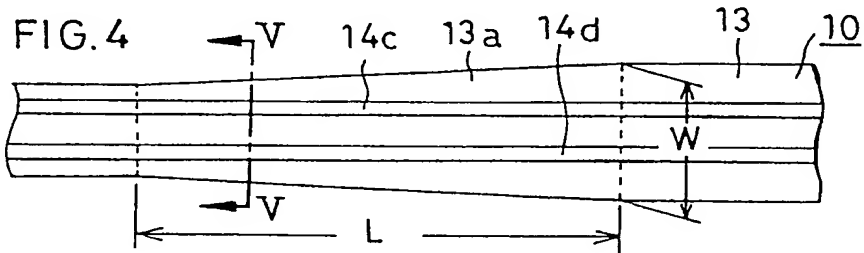
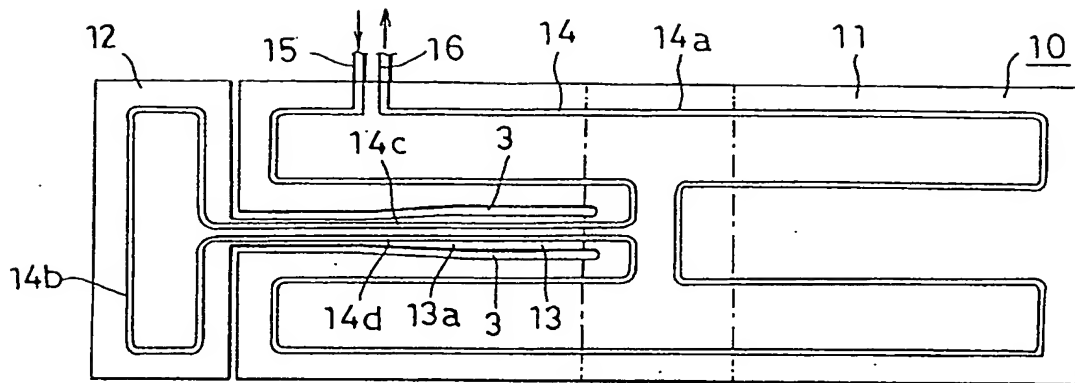


FIG. 6

